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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/645,908	08/22/2003	Yoichiro Numasawa	2003_1164A	8539

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WENDEROTH, LIND & PONACK, L.L.P.  
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SUITE 800  
WASHINGTON, DC 20006-1021

EXAMINER
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SARKAR, ASOK K

ART UNIT	PAPER NUMBER
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2891

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/16/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/645,908

Applicant(s)

NUMASAWA ET AL.

Examiner

Asok K. Sarkar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 August 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claims 7 and 8 are objected to because of the following informalities: The limitation "the frequency of the high – frequency electric field applied in the step of forming a silicon film of nanometer scale thickness composed of fine silicon crystals and amorphous silicon on a substrate is a VHF – range high frequency having a higher frequency than 60 MHz" should be changed to "the frequency of the high – frequency electric field applied in the step of forming a silicon film of nanometer scale thickness composed of fine silicon crystals and amorphous silicon on a substrate is a VHF – range high frequency having a frequency higher than 60 MHz". Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

3. Claims 13 – 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The meaning of the limitation "the high frequency of the high – frequency electric field applied in the plasma oxidizing treatment or plasma nitriding treatment is a high frequency having an LF – range high frequency applied to a VHF – range high frequency having a higher frequency than 60 MHz." is unclear. Presence of unclear limitation within a claim renders the claim indefinite. For

examination purposes the limitation was assumed to be VHF – range high frequency having a frequency higher than 60 MHz.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, 19 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Oda, US 6,887,725.

Regarding claims 1 and 2, Oda teaches a method of forming an oxygen – or nitrogen – terminated silicon nanocrystalline structure, which comprises a step of forming a silicon film of nanometer scale thickness (column 6, line 41) composed of fine silicon crystals and amorphous silicon on a substrate and a step of oxidizing or nitriding the formed silicon film with ions and radicals formed from an oxidizing gas or a nitriding gas in between column 3, line 47 and column 4, line 30. The plasma treatment inherently creates the ions and radicals.

Oda does not explicitly teach the amorphous silicon but it is inherently present in the film due to the process of making the film on the substrate. Oda teaches the sequential second step of oxidizing or nitriding the formed silicon film with ions and

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radicals formed from an oxidizing gas or a nitriding gas is conducted plural times in column 4, lines 30 – 32.

Regarding claims 19 and 20, Oda teaches an oxygen – or nitrogen – terminated silicon nanocrystalline structure as was explained in rejecting claims 1 and 2. These claims are product by process claims.

Note that a “product by process” claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above case laws make clear.

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 3 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oda, US 6,887,725 in view of Ueda, US 6,090,666.

Regarding claims 3 and 4, Oda teaches forming the silicon nanocrystals and Amorphous silicon using a thermal catalysis reaction in a gas system containing silicon hydride and argon in column 3, lines 47 – 58, but he fails to teach hydrogen gas.

Ueda teaches the use of hydrogen gas or argon gas as functionally equivalent (no oxidizability) for forming silicon nanocrystals in column 7, lines 60 – 67 for the benefit of forming silicon nanocrystals of high controllability and less variable in density and size in column 3, lines 35 – 40.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Oda and use hydrogen gas as being functionally equivalent to Ar and also for the benefit of forming silicon nanocrystals of high controllability and less variable in density and size as taught by Ueda in column 3, lines 35 – 40.

Regarding claims 5 and 6, Oda teaches the conditions used for their nanocrystal preparation in the table of column 11 such as reduced pressure and applying high frequency electric field (column 10, lines 12 – 20) except that he fails to teach hydrogen. However, the use of hydrogen in place of argon was described earlier in rejecting claims 3 and 4. The temperature used by Oda is room temperature but as Ueda teaches that temperature can be also varied (column 9, lines 30 – 67) for the benefit of controlling the density of crystal nuclei generated.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Oda and use higher temperature) for the benefit of controlling the density of crystal nuclei generated as taught by Ueda.

Regarding claims 7 and 8, Oda teaches applying VHF, higher than 60 MHz in column 10, lines 13 – 20.

Regarding claims 9 and 10, Oda teaches these limitations in column 10, lines 39 – 64.

Regarding claims 11 and 12, Oda fails to teach using HF – based gas for etching treatment of the surface of the silicon crystals in the silicon film.

Ueda teaches using HF in their process in column 13, lines 40 – 65 for the benefit of forming the crystal nuclei in the amorphous film in column 13, lines 34 – 35.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Oda and use HF – based gas for etching treatment of the surface of the silicon crystals in the silicon film for the benefit of forming the crystal nuclei in the amorphous film as taught by Ueda in column 13, lines 34 – 35.

Regarding claims 13 – 16, Oda teach VHF over 60MHz as was described earlier in rejecting claims 7 and 8.

Regarding claims 17 and 18, Oda teaches the film thickness to be in the range of 1 micrometer in column 6, line 41.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control the thickness of the film during the preparation of the silicon nanocrystalline film by the plasma process through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

Note that the specification contains no disclosure of either the critical nature of the claimed processes or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen methods or upon another variable recited in a claim, the Applicant must show that the chosen methods or variables are critical (*Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir., 1990)). See also *In re Aller, Lacey and Hall* (10 USPQ 233 – 237).

### **Conclusion**

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone



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number for the organization where this application or proceeding is assigned is 571-273-8300.

11. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Asok K. Sarkar  
January 5, 2007

Primary Examiner